OREGON DEPARTMENT OF FISH & WILDLIFE

Fish Passage Criteria

AUTHORITY and PROCESS

Since August 2001, the owner or operator of an artificial obstruction located in waters in which native migratory fish are currently or were historically present must address fish passage requirements *prior to* installation, major replacement, a fundamental change in permit status (e.g., new water right, renewed hydroelectric license), or abandonment of the artificial obstruction. Native migratory fish include native salmon, trout, lamprey, sturgeon, suckers, and a few other species. Addressing fish passage requirements entails the owner/operator obtaining from the Oregon Department of Fish and Wildlife (ODFW): 1) approval for a passage plan when passage will be provided, 2) a waiver from providing passage, or 3) an exemption from providing passage. Laws regarding fish passage may be found in ORS 509.580 through 910 and in OAR 635, Division 412.

In most cases passage should be provided at the artificial obstruction (option #1) and passage plans and installed structures must comply with the criteria found in this document. Fish passage criteria and design are normally based on the migration timing and swimming ability of the weakest individual of the weakest species and life history stage of native migratory fish which are present that require upstream access. Thus, it is important to identify this information for the location in question.

With the above items in mind, here are some key steps for addressing fish passage if an artificial obstruction will undergo construction (including major replacement), a fundamental change in permit status, or abandonment:

1. *Native Migratory Fish Determination*. A local ODFW biologist should be contacted to determine native migratory fish presence at the site. If native migratory fish are or were historically present then fish passage must be addressed. Project proponents should assume that fish passage must be addressed regardless of stream size or seasonality if no determination from ODFW regarding fish presence is requested.

2. *Fish Passage Criteria and Design Information.* If native migratory fish are or were present at the site and passage must be addressed, then the local ODFW biologist should also determine the specific native migratory fish species, life history stages, and migration timing (i.e., months of the year passage is required for these fish) at the site. For certain passage design methods this information will determine which passage criteria must be met. If approved by ODFW's Fish Passage Coordinator, ODFW management objectives and other relevant factors may allow deviation from the timing and/or weakest species or stage design requirements. Project proponents should assume that the weakest fish contained in the criteria are present and require passage regardless of stream size or seasonality if no determination from ODFW regarding fish passage needs is requested.

3. *Passage Plan Approval*. Once a structure has been designed, a local ODFW biologist should be contacted to obtain passage plan approval if ODFW approval is not explicitly obtained through another State of Oregon permitting process such as the Oregon Department of State

Lands' fill-removal permitting or the Oregon Department of Forestry's forest practices notification. Note that complicated structures requiring engineering review, such as hydraulic-method culverts, fishways, and tidegates, will take more time for approval due to the nature of the structure and potential need to also involve ODFW statewide engineering staff.

4. *Waiver or Exemption Information*. If the project proponent does not desire to provide fish passage at the site, a local ODFW biologist should be contacted to obtain more information on waivers and exemptions.

Note that complying with ODFW's fish passage requirements is likely not the only regulatory approval needed to perform many actions at or in relation to an artificial obstruction. Oregon Department of State Lands, Oregon Water Resources Department, US Army Corps of Engineers, NOAA Fisheries, other ODFW sections (e.g., habitat and fish salvage), or other local, state, or federal agencies may also have permits or requirements which must be met.

CRITERIA

If passage must be addressed and is provided, passage plans and installed structures must comply with the criteria found in this document, unless a specific exception is approved by ODFW's Fish Passage Coordinator. The criteria contained in this document are primarily a re-organization for clarification of those contained in the 1997 criteria document titled "*ODFW Guidelines and Criteria for Stream-Road Crossings*". ODFW plans to update these Fish Passage Criteria in 2005 through a process that will involve the public and affected parties. Contact the ODFW Fish Passage Coordinator for more information.

To date, ODFW's Fish Passage Criteria contain few criteria for fish ladders, tidegates, fishways in tidal and/or static water (e.g., wetlands), and passage structures other than bridges or culverts. Where specific criteria are absent, ODFW will base approval decisions on the best current design practices for such structures and, if needed, work with project proponents to identify appropriate designs.

For road crossings (i.e., culverts or bridges), either of two design and installation methods (*Stream Simulation* or *Hydraulic*) may be used as long as the respective criteria are met for that method. However, the *Stream Simulation Method* is preferred and the project proponent must briefly justify the use of the *Hydraulic Method*.

Note that downstream passage criteria at dams or other artificial channel-spanning obstructions are addressed in ODFW's fish screening requirements. Contact the ODFW Fish Screening Coordinator for more information.

The following table, notes, and sections contain ODFW's Fish Passage Criteria:

Criteria	CULVERTS or BRIDGES[a]		FISHWAYS
	Stream Simulation Method	Hydraulic Method	
Design Flows	N/A[1]	see DESIGN FLOWS	see DESIGN FLOWS
Water Velocity	N/A[1]	see WATER VELOCITY	N/A
Minimum Water Depth	same as adjacent stream[1, 2]	•12": adult steelhead and chinook •10": salmon other than chinook, sea-run cutthroat trout, other trout over 20" •8": other trout under 20", kokanee, juvenile steelhead and salmon	see *Jump Pool Depth*
Maximum Jump Height	0"	•12": adult steelhead and salmon •6": trout, kokanee, juvenile steelhead and salmon	•12": adult steelhead and salmon •6": trout, kokanee, juvenile steelhead and salmon
Jump Pool Depth	N/A	greater of: •1.5 x *Jump Height* •24"	greater of: •1.5 x *Jump Height* •24"
Slope of Structure	same as adjacent stream[2]	•less than 0.5% if not embedded, not baffled, or not backwatered •up to 5% if baffled •5-12% if with a fish ladder or integral weirs	N/A (jump height and pool length dependent)[2]
Width of Structure	active stream channel[2, 3]	N/A	N/A[4]
Length of Structure	no limit	less than or equal to 100', if juvenile passage required	N/A
Depth of Fill in Structure (i.e., Embedded Depth)	greater of[1]: •12" •20% of structure's height	N/A	N/A
Hydraulic Controls[b]	site-specific	site-specific[5]	site-specific
Trash Racks	highly discouraged; only above ordinary high water line *and documented maintenance problem*	discouraged; only above high flow design elevation	site-specific; determine need and design with ODFW
Structural Integrity[c]	100-year flow	100-year flow	N/A
Construction Practices	see CONSTRUCTION	see CONSTRUCTION	see CONSTRUCTION

NOTES

[a] Bridges with supports, approach embankments, or protection (e.g., rip rap) that constrict the active stream channel (see Note [3]) must meet criteria for the *Hydraulic Method*.

[b] Hydraulic controls may be required to (1) improve structure entrance and exit conditions (e.g. using a beveled inlet configuration; providing resting pools at entrance and exit; etc...), (2) concentrate low flows, (3) prevent erosion of stream bed and banks, or (4) allow passage of bedload material. The need for, and design of, these project features should be developed in consultation with ODFW.

[c] Culverts and associated fill should be designed using standard engineering design practices to maintain structural integrity to the 100-year flow. This does not mean that the culverts must be able to convey the entire volume of this flow through the structure at one time.

[1] *Stream Simulation* refers to a design and installation method where substrate and flow conditions in the crossing structure mimic the natural streambed above and below the structure. Therefore, the material placed in an embedded *Stream Simulation* culvert should mimic that of the adjacent stream. The "roughness" of this stream material in the embedded culvert provides "hydraulic shadow" (natural low velocity variations in flow) which fish may utilize for passage or rest. Although the streambed is mimicked in the *Stream Simulation Method*, it likely will not be exactly reproduced because the culvert will not be an un-constricted stream and will lack certain features (e.g., undercut banks, large wood, floodplain) to accommodate these important streambed functions: accumulate bedload, retain existing bedload, pass bedload, and not allow sub-surface water flows. To date, our best experience has shown the following mix of fill/bed material provides the best streambed function and, thus, fish passage:

- 30% fines (dirt or silt; this allows the new bed to "seal" and water to remain in the channel rather than sub-surface)
- 30% small rock (½-6" diameter)
- 30% large rock (6"-D_{100})
- 10% "shadow" rock (D_{150}-D_{200}; these simulate undercut banks, large wood, and boulders and should remain in place during flood events)

Note: D_{100} rock is the size (diameter) of the largest rock found naturally in the stream. D_{150}-D_{200} rock is 50-100% larger than the largest rock found naturally in the stream. Shadow rock should protrude 30-50% above the final streambed elevation. During construction, the small rock, large rock, and fines should be mixed before placing. The final surface should be washed with water to allow the fines to work into interstitial spaces and provide a good seal, and demonstrate that this seal has occurred.

Although there are no specific criteria in place to date, streambed function must be accounted for in the *Stream Simulation Method*, and deviations from the above mix should be justified. The considerations discussed in this note for embedded culverts should also be taken into account for *Stream Simulation* bottomless culverts and bridges if the stream channel is highly disturbed or being restored.

[2] This value should be based upon stream reach conditions prior to any impacts of existing structures (if present) at the site in question. Thus, values should be based on multiple stream measurements above and below the site and outside areas where channel characteristics have been influenced by any existing structure at the site. Note that it is a good idea to consider the impacts to the surrounding stream (e.g., headcuts) of placing the new structure, especially if an existing structure has previously altered the stream (see Note [b]).

[3] The width of the active stream channel is the stream width that occurs annually at ordinary high water. This width can be determined by measuring the stream's cross-sectional distance between the ordinary high water line (OHWL) on both banks of the stream. See OAR 141-085-0010(150) for physical characteristics that can be used to determine the OHWL in the field. The OHWL excludes exceptionally high water levels caused by large flood events (e.g. 100 year events).

[4] Pool size, turbulence, attraction flows, and other fishway design criteria are not addressed in ODFW's current published criteria, but will be considered for each structure during *Passage Plan Approval* by ODFW. Until ODFW revises its criteria, NOAA Fisheries' criteria should be used for guidance in these areas.

[5] Although not required, corrugated metal culverts are preferred over smooth-surfaced culverts. Deep corrugations are preferred over shallow corrugations.

DESIGN FLOWS

This section is only applicable to a) culverts and bridges designed under the *Hydraulic Method* and b) fishways.

Low Flow Design

Low flow design should be used to assure the *Minimum Water Depth* criteria for the migration period of the fish species/stage of concern and may be either:

- the 2-year, 7-consecutive-day low flow discharge, or
- the 95% exceedence flow

High Flow Design

High flow design should be used to assure *Water Velocity* criteria are met for culverts and bridges and help design water surface elevations, pool dimensions (to limit turbulence), and attraction flows for fishways. The high flow design should be the 10% ($Q_{10\%}$) exceedence flow during the months of adult migration. If available, existing data (e.g., USGS statistical summaries, or site-specific measures available on the web) can be used to determine $Q_{10\%}$. The following formula can be used to approximate $Q_{10\%}$ if no data are available:

$$Q_{10\%} = (0.18 \cdot Q_2) + 36,$$

where Q_2 is the 2-year flood event in cfs. For cases where Q_2 is less than or equal to 44 cfs, the design flow ($Q_{10\%}$) should be approximated as equaling Q_2.

WATER VELOCITY

This section is only applicable to culverts and bridges designed under the *Hydraulic Method*, and is based on a fish's ability to sustain swimming through a culvert. Average water velocity (fps) at high flow design must be no greater than:

Culvert Length (ft)	Salmon & Steelhead	Adult Trout (>6")	Juvenile Salmonids
Under 60'	6.0	4.0	2.0
60-100'	5.0	4.0	2.0
100-200'	4.0	3.0	*see Note below*
200-300'	3.0	2.0	*see Note below*
Over 300'	2.0	1.0	*see Note below*

Note: For juvenile fish, only the *Stream Simulation Method* will be considered for culverts over 100' in length.

CONSTRUCTION

- Disturbance of the bed and banks should be limited to that necessary to place the structure, embankment protection, and any required channel modification associated with the installation.

- All disturbed areas should be protected from erosion within seven (7) calendar days of completion of the project using vegetation or other means.

- The banks should be revegetated within one year with native or other approved woody plant species. Live stakes should be planted at a maximum interval of three feet (on center) and maintained as necessary to ensure 80% survival.

- Approved structures should be constructed in the dry whenever possible. If in-water excavation is anticipated, timing of same shall conform to ***Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources*** unless an exception is approved in writing by an ODFW biologist (note: if a Fill-Removal Permit is required then the Oregon Department of State Lands will also need to approve this exception). Where significant live flow exists, isolation of the construction site from stream flow is required. Techniques for isolation include:

    a) installation of a bypass channel, pipe, flume, or culvert,
    b) installation of a sheetpile or sandbag wall,
    c) use of a water-filled cofferdam,
    d) by pumping the stream flow around the site (with approved fish screen), or
    e) reduction of siltation or turbidity to acceptable levels by other means approved by ODFW

- Any fish stranded in the construction area or diversion reach shall be safely moved to the flowing stream by an authorized person.

- Any wastewater from project activities and dewatering shall be routed to an area outside the ordinary high water line to allow settling of fine sediments and other contaminants prior to being discharged back into the subject stream.